Makin' Paper

A **Wood Magic Forest Fair** learning station for 4th graders

2023 edition (new science standards highlighted in yellow)

Objective

Students will be able to explain why recycling is important and will be able to describe the basic steps in the papermaking process.

Overview

Students will discuss the need for recycling, including the components of municipal solid waste. They will learn how paper is made; both from virgin fiber and from recycled paper and will recycle tissue paper into new paper.

2021 SC Science and Math Standards

Earth and Human Activity (ESS3)
4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and how their uses affect the environment.
4.NSBT.5 Multiply up to a four-digit number by a one-digit number and multiply a two-digit number by a two-digit number using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using rectangular arrays, area models and/or equations.

Materials List

"How Paper is Made" poster (approx. 18" x 24") – enlarged from Bowater coloring book

Paper Recycling poster (approx. 18" x 24")

Student Papermaking Kit (1 per student plus one for instructor – need 31)
- Baby food jar – two-thirds full of water
- 3 squares of toilet tissue
- 8" x 4" piece of hardware cloth screening
- yogurt container
- 4 oz. metal can with both ends removed
- 1 full sheet of newspaper folded in half 3 times
- 1 pencil
- 1 woodchip
- 1 student cover sheet - "Making Paper from Paper" (see end of lesson plan)

Small pile of wood chips

4 staplers

Recycling bin with samples of recyclable items – al. can, steel can, plastic bottle, glass bottle, newspaper, magazine)
Globe

Cardboard egg carton, cereal box, newspaper, tissue

Corrugated paper, computer paper

Marker and easel with poster paper to demonstrate math calculation

Preparation
Set up student papermaking kit at each child's seat. Organize teaching materials at front of room for easy access for instructor(s).

Step-by-Step Procedures

1. Ask,"Who can tell me one thing they have learned today?"
2. "Raise your hand if you can tell me the name of the planet we live on." [*show globe*]
3. "Raise your hand if you can tell me the name of the country in which we live." [*point to US on globe*]
4. "Did you know that every person in the US uses almost 750 pounds of paper each year?"
5. "Raise your hand if you weigh about 75 pounds. It would take 10 of you to weigh as much as the stack of paper that you use every year!" [*Count off 10 kids and have them stand up. Demonstrate algorithm for calculation on poster paper.*]
6. "Who can tell me what paper made from?" [*trees*]

7. "Paper comes from trees in **3 main ways**. Have you been to the sawmill yet? What do they do with the wood chips and scraps left over when a board is cut?" [*send the chips to the paper mill*] "At some sawmills that have power stations, the scraps can burned to make their own electricity. The sawmills can also send their scraps to paper mills, where they use the scraps to make paper! About one-third of all paper is made from **wood scraps**."

8. "How about the trees that are **thinned out** to give the trees more room to grow? Although some might think cutting any tree is harmful to the forest, it actually allows the remaining trees to grow faster because they are given more of a limited resource, space. Trees that are too small or twisty to make into nice, straight boards are chipped up and made into paper. So, another third of paper is made from small trees."

9. "The final third of all of the paper that is used is made by grinding up paper that people **recycle**. Each year we try to use even more recycled paper in the new paper products that we make. Why? Because recycling helps us keep the planet cleaner and helps to make the most of our natural resources."

10. "Who can tell me what a '**natural resource**' is?" [*a gift from nature*]
"We call this the Wood Magic Forest Fair because trees are kind of a magical natural resource. We can cut them, use them, plant them, and grow them again."

11. "Does anyone know what we call natural resources that can be grown again and again?" [***renewable***] "Of course, we still want to use them wisely. Let's take paper, for example. Maybe you need to write yourself a note to remember to bring your homework to school tomorrow. Do you ever write yourself a little reminder note like that? Well, you could get a whole sheet of notebook paper and write something like, 'Bring homework tomorrow,' but that's only 3 words and it would be kind of wasteful to use a whole sheet of paper for just 3 words! So, you could use a small sheet of paper or tear off a piece of notebook paper. That way, you are *reducing* the amount of paper you are using.

"Another way you can use paper wisely is to *re-use* it. Instead of just throwing that note to yourself away tomorrow after you look at it and remember to bring your home-work with you, maybe you could stick it inside your notebook and use the back side of it for another note some other day. That would be *re-using* the same piece of paper.

"A third way to use paper wisely is to recycle it. Some schools and businesses have special recycling bins where you throw away used notebook paper. Instead of being taken to the landfill, this paper is *recycled*. So, three ways to use paper wisely are: *reduce, re-use, recycle*. Can you say that with me,"REDUCE, RE-USE, RECYCLE; REDUCE, RE-USE, RECYCLE; REDUCE, RE-USE, RECYCLE. Good!"

12. "Now, let's look at how paper is made. [*show Bowater drawing "How Paper is Made." Go through the steps of the papermaking process. Point out where in the process recycled paper would be added.*] Some paper is made completely from wood chips that are small trees that have been ground up or were scraps of wood from sawmills. Other paper is made from a combination of wood and recycled paper. [*show corrugated, computer paper*] And some paper can be made entirely from recycled paper. " [*show egg carton, cereal box, tissue paper, newspaper*].

13. "Where does our paper go when we are finished with it? Well, if we put it in the recycling bin it goes to a recycling facility and then to a paper mill where it becomes new paper. If we put it in the trash can it goes to a *landfill*. Raise your hand if you have ever seen a landfill. A landfill is basically a big hole in the ground that we fill up with garbage. Modern landfills are huge – bigger than 40 football fields put together and twice as tall as most trees! They are mountains of garbage! Because we throw away many poisonous materials like batteries and chemicals, special liners and water filtering systems have to be put in the bottom of landfills to protect our groundwater. This makes building landfills very expensive. The average cost of building a landfill in SC is $1 million per acre. How many of you would like to live next to a smelly landfill? Nobody wants to live near one. There's a funny-sounding abbreviation for this: ***NIMBY – Not In My Backyard***. No one wants a new landfill to be built near where they live – certainly not in their backyard! Since people are moving out into the country a lot these days, it's getting harder and harder to find a place for a new landfill that's not in someone's backyard. " [Landfill space is *nonrenewable natural resource*.]

14. "One more thing about this landfill problem. Did you know that 1/3 of what gets thrown away and ends up in a landfill is paper and cardboard?! By recycling paper we can cut our garbage problem by a third!"

SO, the major reason to recycle paper is to save landfill space, which is a non-renewable resource. Trees are a renewable resource. We are running out of landfill space, but we will always have plenty of trees if we manage the properly.

15. "Today, we're going to make recycled paper. In front of you is a paper making kit. When factories recycle paper, they shred the used paper and mix it with lots of water to turn it into pulp. The pulp is poured onto screens, and machines press the water back out. The paper is then dried on rollers. Show the student a sample paper and tell them this is what they will be making.

We will follow the same steps:

- Put water in your baby food jar ¾ full. *(Volunteers will do this before students arrive.)*
- Tear three squares of dry tissue into small pieces and put them in the jar.
- Stir the pulp with your finger
- Put one end of your screen on top of your yogurt container with a bottom on it. Please the screen off center so there is room to later fold it. *(Volunteers can do this ahead of time.)*
- Place the yogurt contain with no bottom on top of the screen. *(Volunteers can do this ahead of time.)*
- "DUMP" the pulp into the top cup all at once to keep the paper and water from separating. *(Students need to do this quickly in one motion or pulp with stick to the bottom of the jar. It helps to count it off and have all students dump on 3.)*
- Remove the top cup. (*If you don't like the way the paper looks, start again.)*
- Fold the other end of the screen over your new paper circle, turn it vertical, and squeeze excess water back into jar.
- Place the "screen sandwich" inside a folded newspaper.
- Roll with the wooden roller to get even more water out.
- Write your name on the cover of the Makin' Paper booklet.
- Put paper circle inside booklet (*Instructors and helpers need to staple the 3 open sides of each student's booklet).*

- Collect all booklets and put in a ziplock bag for the teacher to take home.
- Open the cover paper at home and let your recycled paper dry overnight.
- Use your paper the next day (to write, color, cut, paint, etc.)."

16. Sing the "Use it Twice" song:

"Paper here and paper there,
Stacks of paper everywhere.
Put it in the recycling bin.
Use that paper over again.
Advice! Be nice! Use it twice!"

"You did a great job! Would you like to sing it again? OK, here we go!" [sing the Use It Twice Song again]

17. If you have time, review what you've covered today. Say, "Raise your hand if you can tell me:
    a. How much garbage does each person generate each year? *[750 pounds]*
    b. What is an example of a non-renewable resource? *[landfill space, oil, gas, coal, aluminum]*
    c. What are some examples of things that can be recycled? *[aluminum cans, newpapers, office paper, glass, plastic bottles, cardboard]*
    d. What one way we can conserve and protect Earth's resources? *[Recycling conserves landfill space, makes good use of our natural resources]*
    e. Why don't paper companies use only recycled paper to make new paper?" *[the fibers in recycled paper aren't strong enough for all kinds of paper; many types of paper must be made from wood chips so they will be strong]*

Note: At the end of each class (or end of the day), please lay out the newspaper to dry so we can use it again. Please do not throw away this newspaper unless it gets ripped and can't be used again.